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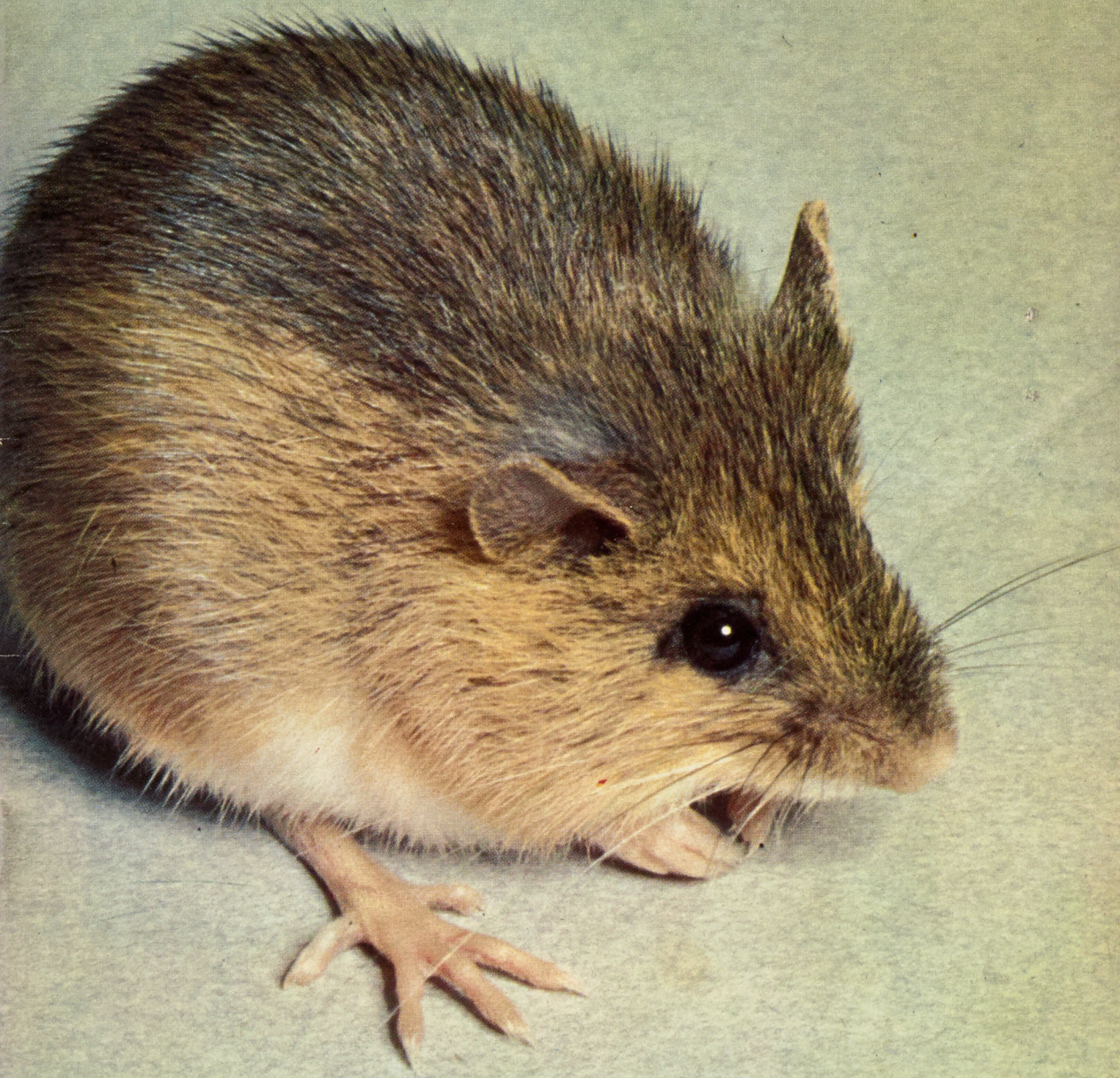

Our cover shows a Woodland Jumping Mouse, much larger than life.
Photo by R.E. Wrigley

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Zoolog, Volume 12, Issue 2, June 1971
Publication of the Zoological Society of Manitoba and the Natural History Society of Manitoba
Editor — Dieter H. Schwanke
Associate Editor — Peter Press

Free to members of the Zoological Society of Manitoba and members of the Natural History Society of Manitoba
Mailed subscriptions $2.00 per year. Single copy 60¢.
Reprints of Articles on request — send all inquiries to:
Zoolog, Clandeboye, Manitoba.

. . .wee sleekit, cow'rin, tim'rous beast

Robert Burns

H. E. WELCH
President

Two articles in this issue deal with "wee tim'rous beasties". These kinds are often forgotten in our concern over the larger, more conspicuous animals, or if remembered, only with the condescending question, "what use are they?".

Such wee beasties as mice and rodents may in fact be the most important animals. To realize this we must look at their role in the total environment – the ecosystem. Plants trap the sun's radiant energy and transform it into hydrocarbons and complex chemicals. The plants and their stores of organic chemicals are the food of the herbivores such as mice and voles. The herbivores in turn are the food of the flesh-eaters, the carnivores, who may also be the food of other predators. This sequence of food items is called a food chain, and the small mammals, mice and rodents, are obviously one of the important steps in the series.

When we look at animals we should note not only their unique characteristics, but also their role, function, or profession in Nature. If, as in human relationships, we gave less attention to the animals' appearance, and judged the animal more by what they did and accomplished in the biotic community then we would gain greater understanding. For example, when we say there goes the postman or TV repairman, we acknowledge both our acquaintance with the individual and his role in the community. We do this already with some animals such as the wolf and the fox, acknowledging in these terms, something of their predatory habits. Perhaps, when we learn more of these lesser animals – the mouse, sparrow or snake – then their names too will have meaning for us.

The Northern Pocket Gopher (upper) and Plains Pocket Gopher (lower). Note the larger size, grooved upper incisors and larger claws of the Plains species.

Manitoba Pocket Gophers

ROBERT E. WRIGLEY
Manitoba Museum of Man and Nature

Throughout much of southwestern Manitoba are often seen piles of soil, thrust up in an irregular row along roadbanks and edges of fields. Closer examination, even scraping the mound aside, will show no obvious entrance to a burrow. It appears that the soil was dropped there, rather than pushed up from below ground. Continued digging from six inches to several feet further down will penetrate an extensive tunnel system – the world of the pocket gopher.

But what is a pocket gopher, and how does it differ from the many other animals called "gophers"? The scientific name of the pocket gopher, *Geomys bursarius,* gives several clues. *Geomys* refers to an "earth mouse", while *bursarius* means "pertaining to a pouch of skin". Though still a burrowing rodent, it is not really a mouse, as it belongs to a separate family *Geomyidae.* Distinctive characteristics are fur-lined cheek pouches which are external to the mouth, large front feet armed with heavy claws, tubular body, and reduced eyes and ears.

Other rodents in Manitoba often called "gophers" are the ground squirrels – Franklin, Richardson and Thirteen-lined. These members of the squirrel family also have cheek pouches, but internal ones (opening within the mouth) without a fur lining. They spend much of the day moving above ground in the vicinity of the burrow, while pocket gophers almost never emerge for more than a few seconds during the day, and seldom venture far at night.

Pocket gophers are sometimes confused with moles, and the soil mounds produced by both species are similar in appearance. There is only one species of mole in Manitoba, the Star-nosed Mole, found east of the range of pocket gophers. The mole is an insectivore, and is identified by pink, fleshy projections on the nose, with which it detects invertebrates in the soil.

There are two species of pocket gophers in Manitoba. The Northern Pocket Gopher, *Thomomys talpoides,* is widespread in the southwest, while the Plains Pocket Gopher, *Geomys bursarius,* is found in a restricted area south of the Roseau River, its only occurrence in Canada. The ranges

appear to have changed considerably since Soper's summary in 1961, and the museum staff is presently working on this question of distribution.

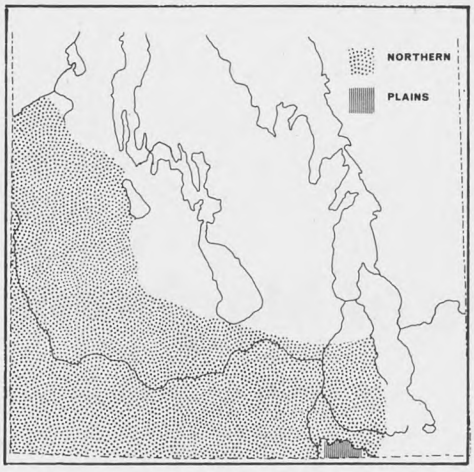
The two species are easily distinguished. The Northern Pocket Gopher averages about nine inches in total length, has a gray pelage, the largest front claw is under one-half inch in length, and the upper incisors lack obvious grooves. The Plains Pocket Gopher averages about ten inches, has a chestnut-brown pelage, the largest front claw is over one-half inch, and two grooves are present on the upper incisors.

Pocket gophers are grassland inhabitants and they generally avoid forested areas, partly because of the difficulty of digging among tree roots. As the forest is cleared for farming, roads and railway lines, avenues are opened for gophers. Through the early stages of succession, gophers thrive on the roots and tubers of grasses and forbs. Invasion of shrubs, particularly trembling aspen, eventually form thick groves which exclude gophers. The mounds of earth thrown up during feeding destroy the grass beneath, enabling shrubs such as snowberry to become established.

Soils do not seem to exert a strong influence on the distribution of pocket gophers in this province. Specimens were recently collected in rich humus, sand, clay and weathered shale, but not in excessively wet soil or gravel. The animals live in higher, well-drained soils during the winter and spring, and when these become dry during the summer, new feeding burrows are directed to moist, low-lying sites.

Pocket gophers are remarkably well adapted for a subterranean existence. The body is compact, with short, powerful limbs. The front foot is armed with five long claws and bristles between the toes which are used in breaking and pushing the soil. Enlarged lips fold behind the massive, protruding incisors, enabling the animal to bite at roots and soil without having material enter the mouth. The fur-lined cheek pouches open by long vertical slits in the outside of the cheek, and extend back to the shoulder region. Food and nesting material are crammed into the pouch by the front feet and transported to deeper chambers, where the material is forced out again with forward thrusts of the front feet. Touch-sensitive ***vibrissae*** on the snout guide the animal through the long, dark passageways, since the small eyes are of no use here. The sparsely-haired tail, also sensitive to touch, enables the gopher to run backwards in the tunnel. The reduced, rounded ears have valves which prevent the entrance of foreign material. A well developed sense of smell assists in the location of food and also the opposite sex during spring mating. The pelvis is relatively small, allowing the animal to turn around easily in the narrow burrow. This presents a problem in the female, since the birth canal is consequently too narrow to permit passage of the young. However, during the first breeding season, a hormone is secreted by the ovary which permanently resorbs most of the pubic bones – a remarkable adaptation to overcome the negative effects of a narrow pelvic girdle.

Pocket gophers prefer to lead a solitary existence and will fight ferociously if another gopher invades an individual's tunnel system. Even in a colony where a dozen individuals may be found within a few acres, the burrows are not united. Only during the breeding season does aggressive behaviour between males and females diminish. During April we noted six



The distribution of the two species of pocket gophers in Manitoba.

occasions where two gophers were inhabiting the same burrow. Individuals must have located the opposite sex by digging into the burrow of another, or by travelling on the surface at night. One to six young are born in June after a four week gestation period. Weaning occurs at about six weeks and the young begin a new tunnel near their old home. Only one litter a year is produced in northern areas such as Manitoba.

The entrances leading to the main tunnels are almost always blocked, but occasionally weasels and the hog-nosed snake gain entrance. The gopher then has little chance to escape these predators. Badgers, foxes and skunks prey on gophers by laborious digging or by finding others while active on the surface. Owls and hawks have been known to capture pocket gophers in surprising numbers, some nests containing the remains of several dozen individuals.

Pocket gophers dig with rapid, alternating strokes of the forelimbs. The loose earth is pushed under the body and then kicked backward with the hind feet. When a pile has accumulated the gopher turns around, and with the forelimbs pushes the mass along the burrow until a side tunnel is reached. The soil is pushed up through this slanting burrow and packed. Successive trips to the exit result in a gopher mound on the surface, ranging in volume from a pint to a bushel. Tunnels excavated while searching for food are generally within one foot of the surface, while deep chambers for nesting quarters, food storage and excreta may extend down to a depth of 12 feet. One gopher may be responsible for a series of mounds spread over one acre. If all tunnels made by one individual were lined up, including those excavated and refilled, they might well extend several hundred yards. In winter, gophers retire to deep nest chambers and subsist on food accumulated during the fall, since they are unable to hibernate. Though the frost soon seals the animals in, some surface activity under the snow occurs since earth cores, formed by filling tunnels in the snow with soil, may be seen in spring.

Though gophers are beneficial in enriching and mixing the soil, their mounds interfere with the operation of farm machinery, and most crops are relished as gopher food. This has led to extermination programs, particularly in the United States, costing many millions of dollars. However, pocket gophers are probably as abundant now as they ever were, and have adapted well to conversion of grassland to crops and pasture.

Jumping Mice of Manitoba

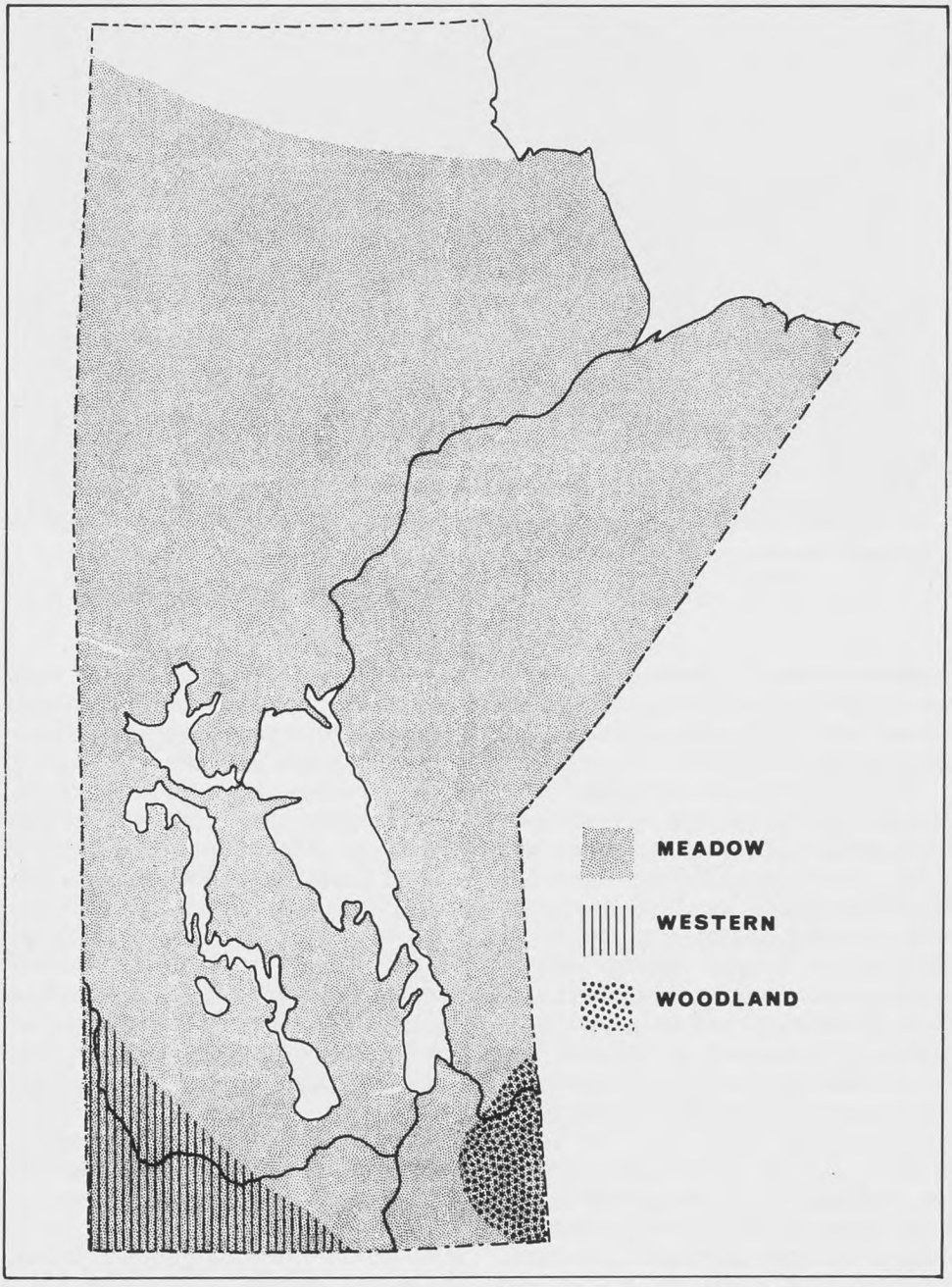
ROBERT E. WRIGLEY
Manitoba Museum of Man and Nature

Jumping mice are small rodents of the family Zapodidae, a name based on the Greek words "very" and "foot" which refer to the exceptionally long hind feet. Further characteristics are the long tail (about 60 per cent of total length) and tricolor pelage – dark brown back, yellowish-orange sides and white underparts. Jumping mice are found in North America and a remote area of China, while close relatives in the same family, the birch mice, occur in Eurasia.

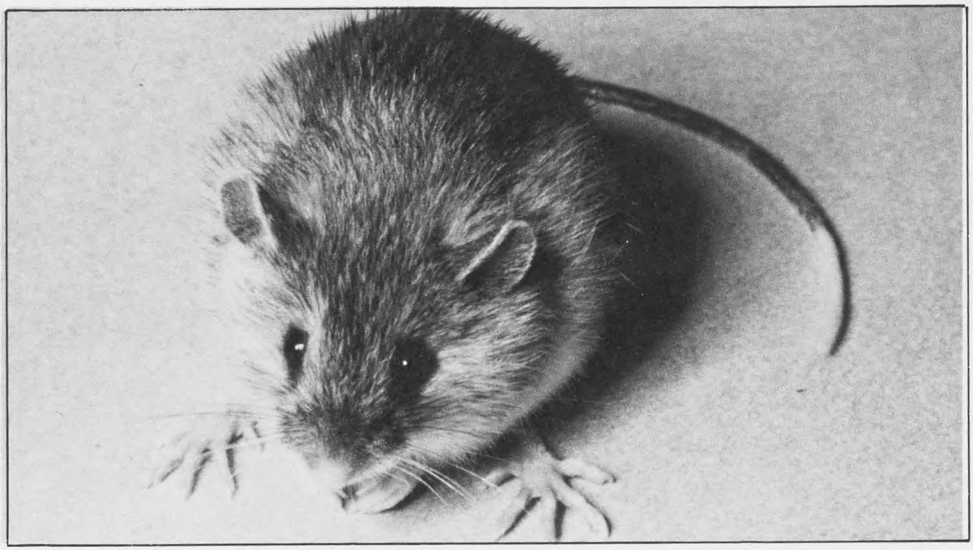
Three species of jumping mice inhabit Manitoba. The Meadow Jumping Mouse is a transcontinental form which occupies all but the northernmost section of the province. It may appear in a variety of habitats such as grass, shrubs, deciduous or coniferous forest, but generally favours moist, open situations with a thick growth of grasses and forbs. The Western Jumping Mouse, as the name implies, is a western species occurring in moist prairie and along the edge of aspen groves in southwestern Manitoba. The Woodland Jumping Mouse is widespread in eastern North America, but has been found at only four localities in the white spruce-poplar forests of southeastern Manitoba.

Jumping mice seldom attain high population numbers and are only locally distributed. The best opportunities for observing them are by walking quietly along the forest edge or creeks bordered by grass or willow-alder shrubs. Although mainly nocturnal, on cloudy days they may forage for seeds, berries, fungi and insects for most of the morning and be out again in late afternoon. When startled, jumping mice retreat by successive jumps of from one to six feet, clearing a height of several feet. After a few erratic jumps in several directions, they "freeze" for many minutes if not pursued, beautifully camouflaged among the dead leaves and grass.

Identification of the Woodland Jumping Mouse, *Napaeozapus insignis,* is relatively simple due to the prominent white tip on the tail. Distinguishing between the Meadow Jumping Mouse, *Zapus hudsonius,* and the Western species, *Zapus princeps,* is difficult without recourse to skull dimensions (the latter averaging larger).



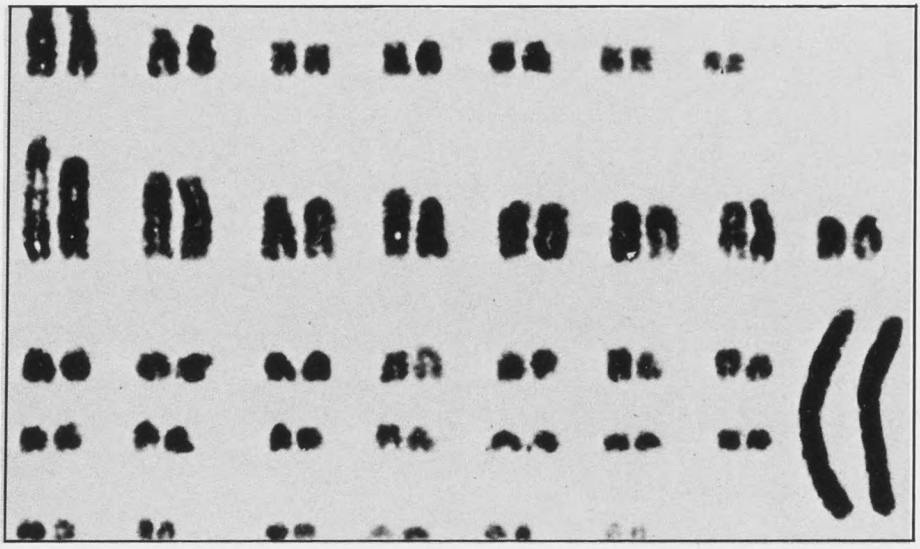
The distribution of the three species of jumping mice in Manitoba.



Woodland Jumping Mouse.

Because of the distributional patterns and relative abundance, the species most likely to be encountered is the Meadow Jumping Mouse.

Jumping mice are among the most pronounced hibernators, remaining in the torpid state for approximately seven months at the latitudes of Manitoba. Males are first to appear above ground, in late April and early May, while females emerge several weeks later. Breeding commences almost immediately and the majority of litters are produced in June. A few females have second litters, in August. After a gestation period of about three weeks, two to seven young are born, in nests usually placed underground but occasionally in brush piles and thick grassy swales. Newborn jumping mice are poorly developed compared to other small mammals, and do not leave the nest until four or five weeks old. By September, young of the year comprise almost 70 per cent of the population. A small percentage may live to be three or four years old, considerably longer than most other small mammals. Jumping mice do not reach sexual maturity the first season. Adults more than one year of age commence hibernation in the latter half of September while young of the year, particularly of late season litters, may be active throughout October. As the days of fall become shorter, the mice moult and begin to accumulate fat, often amounting to one-third of the body weight. Over the next few weeks their sleep becomes progressively deeper and the body temperature often drops. By early October most jumping mice are torpid and do not emerge above ground until the spring. The hibernaculum is situated in a grass-lined burrow, several feet below the surface, generally on a well-drained slope. No food is stored in the burrow, so that if there are insufficient fat reserves to last at least six months,



Chromosomes of the woodland jumping mouse (XX female, X 1250). The chromosomes have been prepared from bone marrow tissue, stained, photographed, then matched to form a karyogram. The 2 large X chromosomes are at the lower right.

the animals perish. Mice without considerable fat deposits are reluctant to enter torpor even at low temperatures. The increased energy demands prior to hibernation are no doubt involved in the female's inability to produce more than two annual litters, and the late entrance of young animals into hibernation.

Jumping mice fall prey to many mammalian carnivores, owls, hawks, and snakes. They are relatively free from predation while hibernating, however many probably perish during this period from insufficient fat reserves, freezing or drowning.

Jumping mice are also unusual at a different level of study. While man has 46 chromosomes (microscopic structures composed of the hereditary units), jumping mice have 72 — a relatively large number for mammals. The X or sex determining chromosome is very large in these mice and easily identified. Normally in mammals, females have two X chromosomes and males only one. It was recently found, however, that about half the female jumping mice reveal only one large X chromosome. Possibly the other X chromosome has lost a segment and can no longer be distinguished from the other chromosomes. In any case, the adaptive value of such a mechanism is difficult to comprehend.

The damage caused by jumping mice on crops and natural vegetation is negligible, since these animals are so rare and spend more than half the year hibernating below ground. Their elusiveness, bright colours, specialized mode of locomotion and profound ability to hibernate (thereby avoiding the winter conditions of Manitoba to which they are ill-adapted) make them fascinating members of our native fauna.

Unusual parasite at Assiniboine Park Zoo

Dr. N. E. STANGER

Last summer several Saiga antelope at Assiniboine Park Zoo were diagnosed as suffering from Toxoplasmosis, a most unusual disease. Toxoplasma was first observed as an intracellular parasite of the spleen and other organs of the African rodent, the Gondi *(Ctenodactylus gondi)* (1908). *Toxoplasma gondii* is a contagious disease of all species, including man.

The disease is manifested by abortion and stillbirths in ewes, and in all species by encephalitis, pneumonia and neo-natal mortality. It occurs naturally in man, and in domesticated and wild animals and birds, in most parts of the world. In the United States serological surveys indicated an incidence of 60% in dogs, 34% in cats, 47% in cattle and 30% in pigs. However, animal losses are small with the exception of abortion in sheep, neonatal deaths in lambs, and dogs. The importance of the disease is the threat to humans, particularly as cats play a major role in the somewhat complicated life cycle of the parasite.

Toxoplasma cysts are intracellular parasites which attack most organs with a predilection for the lymphatic and central nervous system. The parasite invades a cell, multiplies, destroys the cell and is released. These liberated Toxoplasmas reach other organs via the blood stream. The character of the disease varies with the organs attacked.

If the disease is congenitally acquired, across the placentae, encephalitis is common. If the disease is acquired postnatally, pneumonia and diarrhea is common. Nervous signs, fever, incoordination and hyperexcitability occurred in the Saiga antelope. Enlargement of the lymph nodes and liver changes were very evident on post mortem.

Diagnosis in animals is by means of blood analysis. Skin tests and x-rays are of value in human cases.

Drugs such as sulfadiazine are effective against the proliferating

Dr. N. E. Stanger, 1970

parasites but not against the cysts.

Several weeks following the post mortem examinations of the Saiga antelope, the attending animal pathologist developed clinical Toxoplasmosis manifested by very painful and enlarged lymph glands of the neck. Sulfa treatment has resulted in a prompt recovery.

Aurora Borealis

BILL WEBSTER

Virtually everyone in Manitoba has witnessed, at sometime or other, one of nature's most spectacular, and, until recently, least understood nighttime phenomena. The northern lights, or *aurora borealis,* as they are known scientifically, are so common in this part of the country that they generally go unnoticed. Despite our rather unconcerned attitude towards them, auroras remained one of the great mysteries of science throughout most of modern times, and were designated a high priority item for study during the International Geophysical Year period, 1957-1958. Much of our present knowledge of auroras has resulted from those studies, and their continuation in subsequent years. Perhaps the most interesting aspect of aurora investigation is that Manitoba, because of a combination of geographical factors, has contributed more to our knowledge of the subject than any other single location in the world.

Anyone who has observed auroral displays with any regularity, will certainly be aware of the fact that they never seem to be quite the same. Although we do find a tremendous variety of auroral forms, it is possible to categorize them in a general fashion. There are three main types of auroras: there are forms without any ray structure, those with ray structure, and flaming auroras. The ray structures referred to are usually seen as vertical rays or bands in the display . The types without ray structure are generally the least spectacular auroral forms. They can appear as bands, arcs, arcs that pulsate brightness, and amorphous patches of light. The rayed variety can also appear as arcs or bands, often folded on themselves giving the familiar curtain-like appearance. Sometimes the vertical rays appear and disappear in isolated bundles as well. Perhaps the most spectacular of the rayed auroras are the corona type. These always appear very high in the sky, near the zenith. The rays all appear to converge toward one spot in the sky, giving the impression of a crown, or dome in the sky. Sometimes only one side of such a structure is formed, and then it appears similar to a fan. The flaming aurora is characterized by waves of light which move rapidly (less than a second) upward, one after the other

from the base of the aurora toward a spot high in the sky. Colour also plays a very important part in auroral displays. There are six recognized colour groups for displays. These are red in the upper part ; red in the lower part ; white, green or yellow; all red; red and green; blue or purple. The types most commonly seen around Winnipeg are in the white, green and yellow category. Another important feature of an aurora is its movement. Some move and change form very rapidly, while others remain stationary for hours. The latter types are generally quite rare, however. It is not uncommon either, for a number of these forms to appear at once, or for one form to change to another. An auroral observer, when making observations, has to take all of the above into account, as well as the position, time, brightness, and duration of the display.

By their very name, it is easy to gather that these phenomena occur in the extreme northern regions of the world (southern as well) and auroras are not unusual occurrences down to about latitude 40^{o} in the western hemisphere, and somewhat north of that in the eastern half of the world. The first clue to the nature of auroral disturbances came when observers discovered that they centred at the North *Magnetic* Pole of the Earth, and not the actual North Pole. The North Magnetic Pole is located in Canada's extreme north, in the arctic islands off our north coast, which is however, still considerably south of the true North Pole. However, the highest frequency of aurora occurrence is not at the Magnetic North Pole, but in a circle, some 20^{o} - 25^{o} south, all the way around it. This region, called the auroral zone, passes through northern Alaska, across parts of the Northwest Territories and right through Churchill at the most southern part of the zone. Moving north again it crosses northern Quebec and Labrador and then across northern Iceland. In the eastern hemisphere, the auroral zone just skims the Arctic Ocean shoreline of Russia. Thus, Churchill is the only place in the world that can provide relatively easy access to the centre of the auroral zone by rail, sea and air.

Auroral activity is so frequent in the zone that some type of disturbance can be observed on as many as 200 nights a year. For the Winnipeg area, this number is closer to 60. By the time you get as far south as Southern Ontario and the midwestern states, the frequency is down to about five nights a year. An aurora in Mexico and similar regions is so rare that it can be expected perhaps once in 20 years.

Thus, during the IGY, Churchill was chosen as the prime area for auroral research, and until recently, has been the most active research centre in the world. The research centre at Churchill was set up so that all of the most useful research methods could be employed. Auroras are observed visually and photographically from auroral observatories. High altitude balloons are used to make on the spot observations up to 150,000 feet. The most exotic research tool, and perhaps the one for which Churchill is best known, is the rocket. These are fired to various altitudes from 60 to 300 miles, and occasionally higher, to measure atmospheric changes during an aurora.

After the IGY program was completed, the rocket investigations were temporarily discontinued. In 1960, the first International Agreement between the United States and Canada for the use of the facilities at Churchill came into being. This was a five year agreement, which was renewed in 1965 for

NRC Photo

An aurora photographed over Churchill shows the typical folded arc, but very little ray structure.

another five years. The research work done there was jointly funded by the National Research Council of Canada and the National Aeronautics and Space Administration of the U.S.

Ground based methods of observing aurora are by far the oldest and have not essentially changed since the late 1800's. This is not to say such methods are not valuable, and they certainly have been extensively employed at Churchill. The main observing method is photographic. By photographing aurora from at least two different observatories about 30 to 50 miles apart, the height and position of the display can be determined. A rather unusual type of camera, called an All Sky Camera is also used. This, as the name suggests, can photograph the whole sky at once. It can take one photo every few seconds, which allows later study of the development and movement of an aurora. Other more sophisticated equipment is also employed on the ground, such as spectrometers, photometers, and radio telescopes, to measure other auroral characteristics.

Until 1958 ground based studies were the only ones carried out anywhere. At this time high altitude balloons came into use for upper atmosphere work. These are very useful for making various measurements up to 150,000 feet and they can stay aloft for at least 24 hours, which allows for the study of long term effects in these regions. Often, prior to a rocket flight, a balloon is sent aloft, which along with ground observations can provide an adequate description of the aurora into which the rocket experiment is fired.

Rockets, of course are the most elegant, but also the most expensive tool used in auroral studies, but they can perform or carry out experiments which can be done in no other way. They are normally used in the altitude

range of about 60 to 300 miles. This is the range in which it is difficult to use satellites because satellite life would be extremely short, due to atmospheric drag. The rockets measure the numbers of electrons and other charged particles which enter the atmosphere at these heights. They make observations in wavelength regions not accessible from the ground, such as the ultraviolet. The rockets are being used to measure electric and magnetic fields during auroral displays. At the height at which an aurora occurs, there would be no other way to do this. There are other events which occur in the auroral zone which are also studied. One important one is the radio interference and communications blackouts which occur during "magnetic storms", events often associated with auroral activity.

All of this of course, requires very sophisticated ground support facilities, which have been provided. Data can be received from as many as three probes at once. These data are stored on tape to be processed later by computers. The telemetry and communications systems at Churchill are as advanced as those at any similar installation in the world. The research activities are carried on all year round, which has led to special cold weather problems which also have been solved to keep the facilities running smoothly at all times.

What have we learned so far? By now we have a pretty good picture of the basic aspects of aurora. We know that they are caused by charged particles, electrons in particular, that enter our atmosphere near the poles. Aurora are associated with sunspot and flare activity on the Sun. Thus we know that the source of these particles is the Sun. What we didn't know until recently, was that our magnetic field traps these particles for long periods of time in regions called the Van Allen Belts. These particles spiral back and forth around the magnetic lines of force, but can't get out. However, occasionally a disturbance or outburst on the Sun will send giant streams of high energy particles in our direction. When these encounter our magnetic field, it becomes somewhat distorted, allowing some of these previously trapped particles to spill into our atmosphere near the poles causing aurora. The light of the aurora is caused by collisions between these particles and air molecules. Of course, there are many different types of aurora which seem to occur under different conditions, which still are not all understood.

The study of aurora is certainly of considerable practical importance. It allows us to gain better understanding of the upper atmosphere and of the Earth's magnetic field; both of which are vitally important to our survival on Earth.

In 1970 the United States decided not to renew the International Agreement for the use of the Churchill research facilities, due to spending cutbacks in science research programs. This, along with Canadian government spending cuts in N.R.C. has effectively curtailed 80% of the research activities there at the present time, and has left the future of the facility in doubt. This, of course, is a very unfortunate situation.

However, we can take some pride in the fact that research carried out at Canada's only Hudson's Bay seaport has gone a very long way toward solving some of the fundamental mysteries of the planet which sustains our species.

Wild Rice

DR. J. STEWART

In recent years this indigenous aquatic grass has received an increasing amount of attention from large food manufacturers, farmers, government officials and university researchers. Prior to this upsurge of interest in wild rice, it had provided food for the native populations of the western Great Lakes region as well as serving as an emergency food source to many of the early explorers (La Verendrye, 1633), trappers and missionaries. Today's attraction for wild rice lies in its flavour and appearance, which together with its high cost, has made it a gourmet item occasionally featured in many of our high class hotels.

Conservationists in the wild rice growing areas of the Great Lakes region have for some time expressed concern about the overexploitation of the natural wild rice stands. They tell us that the dangers to those stands lie mostly in the replacement or alteration of habitat described ecologically as the emergent plant zone in macrophytic succession. Loss in the wild rice habitat can be observed today in the drainage of many of our lakes, rivers and wetlands; flooding practices to ensure hydro levels and cottage owners' satisfaction; and dredging of wild rice sites to allow for swimming and access to summer cottages. Similarly alteration of the wild rice habitat can be illustrated by the literal 'beating to death' of the plant at the start of each harvest; man-induced eutrophication of the water with its subsequent toll of the submerged leaves; pollution of water from industrial wastes; motorboat activity; and introduction of bottom-feeding fish such as the Carp which uproot the young plants.

Man's interest in wild rice is now entirely motivated by economic gain. As a result one can expect changes in the native plant as the breeding program and agricultural practices develop. Also the ecological status of wild rice in aquatic ecosystem will be affected – almost to the point of extinction – as witnessed by the virtual disappearance of rice from many of the rice lakes in southern Ontario.

Historically 'menomin' or 'good berry' to many of the Indian tribes who harvested this traditional crop of wild rice each year, was the primary source of carbohydrate in the diet.

Since this source of food required no sowing or cultivation, the human population was always at the mercy of the environment in that yield fluctuated with growing conditions thus resulting in times of famine interspersed with times of plenty.

Wild rice is distributed throughout the eastern portion of. Manitoba between 49° and 54° N. latitude. The area now enclosed by the Whiteshell Provincial Park provided and still provides much of the rice harvested by the Saulteaux-speaking tribes. Past evidence of ricing camps can be found along the shores of many lakes in the area, for example, Whiteshell, Crowduck, Lone Island, Mallard lakes. Today the rice is still harvested from these regions by band members from 14 reserves who have organized themselves into the Manitoban Indian Wild Rice Producers Co-op. To prevent disagreements over the ricing areas, the provincial department of Mines, Resources and Environmental Management assigns concessions to various pickers, both Indian and non-Indian, with the proviso that only Indians can harvest in provincial and federal parks.

Wild rice is still harvested by traditional practices. Each canoe has two members; one who propels and steers and the other who bends the rice stems with his 18" ricing stick in rhythmic fashion. When the 'stroking' of the rice stems is done properly, very little damage occurs to the plants thus enabling the rice stand to be harvested repeatedly. Some pickers average up to 500 lbs. of green rice per day at peak season and with recent prices ranging from 40¢ to $1.10 per lb., the income can be considerable during the 3 week harvest period. However, production from natural stands is uncertain as witnessed by the statistics over the last decade when figures ranged from 25,000 lbs. one year to over 750,000 lbs. in other years.

By the mid-seventies, it is predicted that the number of pickers using canoes will decrease because of competition from other year-long jobs, high cost of labour, lack of interest by the younger members and unpredictability of harvest yields from each stand worked. In contrast, the development of wild rice as a commercial crop is of interest to the Indian community because of better productive use of family income, and because wild rice is both historically and culturally a part of the Indian life style.

The non-Indian wild rice concession holders also suffer from the unpredictability of yield in spite of the introduction and use of more efficient mechanical h a r v e s t i n g machines. Mechanization of harvesting and processing of wild rice was first introduced to Manitoba by H. Williams of Pointe du Bois and Z. Durand of Winnipeg just after the First World War. No important advances have been made in the production of wild rice until in 1970 when paddy cultivation was introduced to Manitoba by the Wild Rice Development Association at Stead, Black Spruce Farms at Great Falls, and the Manitoban Indian Wild Rice Producers Co-op at Fort Alexander. While this technique of paddy cultivation has been with us since civilization began, it does promise to revolutionize the traditional approach to this industry.

In 1968, the A.D. Little Report on "The Feasibility of Paddy Production of Wild Rice in Manitoba" advocated full scale production of wild rice by paddies and mentioned that a large market exists for processed wild rice at moderate prices. To fulfill this potential demand, efforts are being made to encourage the intensive farming of wild rice in paddies, more efficient mechanical harvesting and processing techniques, and the breeding of disease-resistant, non-shattering strains of wild rice. Today intense cultivation of wild rice is a reality with approximately 7,000 acres of paddies in operation throughout Manitoba, Minnesota and Wisconsin. In 1971 the predicted acreage is 14,000 acres of which over 3,000 acres will be in Manitoba.

Perhaps the prime motivating force behind man's attempt to adapt wild rice to paddy cultivation is that the technique allows man to control the density of plants, weeds and pests, water levels and nutrient requirements. By controlling these environmental variables a sustained and more or less predictable volume of seed can be produced. To date most of the paddy development has taken place on peatlands, or lands of low economic value. However some paddies in Minnesota are located on prime agricultural land, e.g. alluvial clay beside the Mississippi River in Minnesota. Also, ecological studies have indicated that wild rice will grow in a wide variety of soils and habitats provided that sufficient water is present.

Before the implication of paddy production of wild rice can be appreciated, a brief description of the ecology of wild rice will aid in comprehending both the simplicity and complexity of paddy techniques.

Wild rice is known botanically as *Zizania aquatica.* Linnaeus named the specimens sent to him from North America in 1853 after 'zinnion' or 'weed of wheat fields'. The principal range of this annual aquatic grass is centred around the Great Lakes region particularly in Manitoba, Ontario, Minnesota and Wisconsin.

As a plant it is very tolerant to a wide range of growing conditions. In general it grows well in habitats which are not too alkaline, have high organic sediments and sufficient free water present throughout the growing season.

The life cycle of wild rice is typical of any annual grass except that free water must be present during the early stages of growth. Actually the life cycle really begins in September when the ripe seeds shatter individually from each head and embed themselves in the sediment. Once in the sediment the seeds lie dormant during the cold winter months. In early May, they germinate and rapidly produce slender

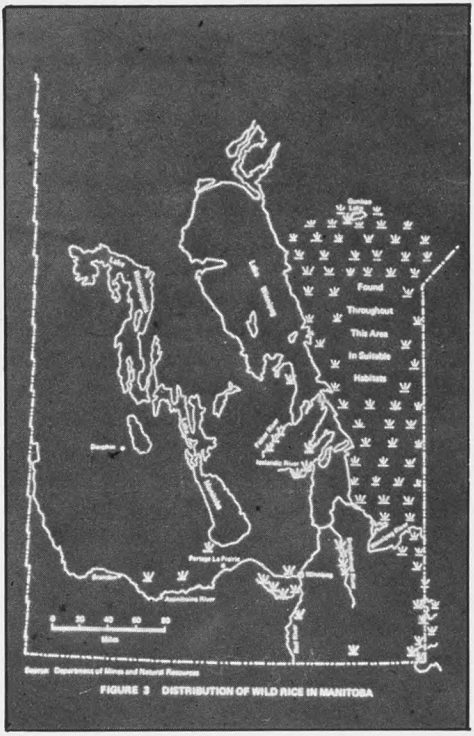
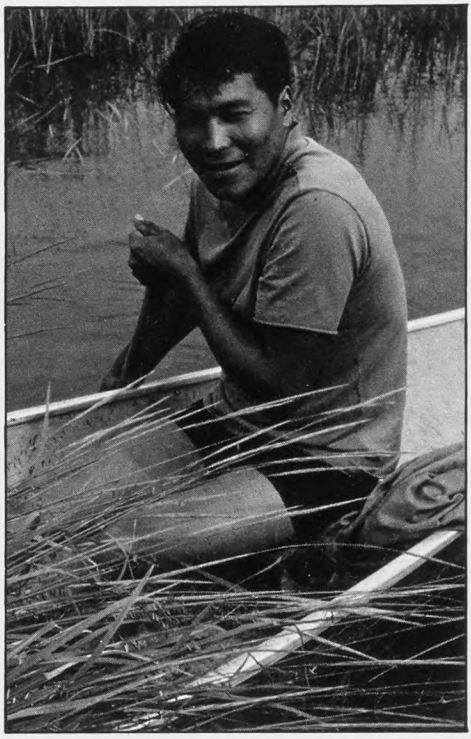


FIGURE 3 DISTRIBUTION OF WILD RICE IN MANITOBA



transparent submerged leaves and roots which anchor the seedlings to the bottom. In June, floating leaves stream over the surface usually in the direction of the prevailing wind. This stage is quickly followed by the upright aerial leaves which first appear in July. By early August these statuesque plants are an average 5' - 8' tall and when fully mature are impressive with their yellow and purple flowering heads. Pollination occurs as soon as the male florets open and the dark ripe seeds begin shattering late in August and early September.

Man, by virtue of his presence, invariably accelerates change of habitat. If allowed, the natural wild rice stands will re-establish their position as dominants in the emergent zone of aquatic ecosystems. However, this is unlikely, judged by the absence of rice in Rice Lake near Peterborough, Ontario, because human population pressure for recreational areas, for example, Whiteshell Provincial Park, is increasing, and wild rice cannot compete successfully with man. It is only in the isolated areas, far away from the summer cottages and motor boat enthusiasts, that wild rice has a chance to re-establish its eminence in the lakes and rivers of its former domain.

Swainson's Hawk in Manitoba

K. A. GARDNER

After a long flight north from their main wintering grounds in Argentina, the Swainson's Hawk *(Buteo swainsoni)* usually arrives on the prairies of Manitoba about the 15th of April. However, as in most species, some individuals arrive earlier, an extreme date being April 2 at Margaret, Manitoba. This is one of the few species of hawks which migrate in large flocks; in one instance a flock estimated at 2,000 birds was observed in Montana during their spring migration. However, these flocks have decreased in size by the time they reach our southern border as the birds have gradually spread out to their nesting territories. Therefore, to be able to observe any spectacular flights one would have to be along their migration route in the western United States or Central America. The largest number I have ever seen in one flock was 18, migrating northwest over Stonewall in company with several other species.

In Manitoba the Swainson's Hawk is most plentiful as a breeding bird in the grasslands area of the southwest. Both Bent (1961) and Godfrey (1966) list such type localities as Oak Lake, Treesbank, Carberry and Aweme. Bent also lists it as breeding as far east as Winnipeg, and northwest to Oak Point. Observations made of adult birds in these regions during the nesting season, plus the discovery of active nests, bear this out. On June 28, 1953, I saw an adult perched on a telephone pole between Woodlands and Argyle and H. Copland noted one ten miles north of Winnipeg on June 29, 1962; both were probably nesting in the vicinity. This species was also seen during the breeding season near the Winnipeg Airport in 1951, 1953 and 1965.

Actual nesting data for Winnipeg and surrounding area in recent years, include four nests in the Stonewall area, approximately 20 miles north of Winnipeg. These were discovered by myself and several companions on May 15, 1954; May 21, 1955; May 9, 1961 and June 11, 1966. All were found within a 6-mile radius of Stonewall in southeast, northeast and northwest directions from the town. Two of these nests were used again in 1969 and adult birds were observed in the vicinity of one of them in 1968 and

again in 1970. This year (1971) a pair were seen at this same site on May 6 and were quite disturbed at my presence. V.H. Scott had two active nests of this species under observation in the Municipality of Rosser (situated between Winnipeg and Stonewall) during the summer of 1967; one of these was again occupied in 1968. Further to the northwest at Langruth, R. O'Connor found a nest on May 21, 1963. Langruth is situated on the west side of Lake Manitoba which is across the lake from Oak Point and about 8 miles further south; it would appear that these localities are roughly the northern limit of this hawk's breeding range in the central portion of the province.

The sparsely treed plains and prairies are the preferred habitat of this hawk. Here the nest is placed in a tree varying in height from several to a hundred feet above the ground but averages about 30 feet high, often depending, of course, on the type and height of trees found in the particular region. Nest trees are most often located in small bluffs but some nests have been discovered in trees growing singly on the prairie as well as in low bushes close to the ground, and even on the ground itself. Those found near Stonewall ranged in height from 15 to 30 feet and were placed in either white or black poplar. The nest itself is not unlike that of other large hawks and is constructed mainly of small sticks and twigs with an inner lining of finer materials such as bark fibre, dry grass or other plant material and a little down from the adult hawks.

Swainson's Hawks, unlike any of the other raptors whose nests I have found, will abandon their nest on slight provocation. If no eggs have been laid or if the clutch is not complete and the nest is disturbed, it is quite likely they will desert; in fact they may do so even if a full clutch has been deposited. After deserting a nest a new attempt is usually made (sometimes nearby) which is probably the reason for "late" clutches being discovered in June, when actually this could be their second or third attempt. A full clutch of these birds is usually two eggs, occasionally three, rarely four; the eggs vary from a pale blue to a dull white and most of the time are sparingly and irregularly marked with brown, rarely immaculate. The incubation period is about 28 days. In Manitoba, nesting normally gets underway about the beginning of May.

Aggressiveness displayed by raptors in defence of their eggs or young varies not only by species but also by individual birds. Of the five species of hawks whose nests I have found most frequently, the most aggressive were the Red-tailed Hawk *(Buteo jamaicensis)* and Marsh Hawk *(Circus cyaneus)* of these certain individuals were much more aggressive than others. More than once I have had to duck my head or dodge behind a branch to avoid being struck with razor-sharp talons after being strafed by these species. Broad-winged Hawks *(Buteo platypterus)* and Cooper's Hawks *(Accipiter cooperii)* circle at close quarters and scream their defiance but I have never had one attack me. Least aggressive of all have been Swainson's Hawks. When their nest tree is being climbed they at first circle at close range overhead uttering their plaintive cries, but eventually soar higher into the sky and farther away, still calling, and do not usually come close again. The male often disappears altogether.

The Swainson's Hawk feeds almost


J. CARSON 1/71

entirely on small rodents and large insects with the occasional frog taken. The few birds that are taken on rare occasions are usually the smaller ground-frequenting species and more often than not are the flightless young which are much easier for them to capture. One Swainson's Hawk, however, was found dead near St. Lazare, Manitoba, on June 11, 1966, had its stomach full of bird remains. Its most vulnerable prey in Manitoba are the Richardson's Ground Squirrel *(Citellus richardsoni),* Thirteen-lined Ground Squirrel *(Citellus tridecemlineatus)* and the Meadow Vole (*Microtus pennsylvanicus).* Among the insects, grasshoppers and crickets are frequently preyed upon. When hunting, these hawks circle above the prairie or watch from a favored perch such as a mound of earth, a tree, pole or fence post. Unfortunately they are very trusting birds and while perched near a road or farm on the lookout for some unwary rodent, often fall prey themselves to some irresponsible person toting a gun.

Like most species of *buteo* in North America the Swainson's Hawk appears in both a normal (pale) colour phase and a melanistic (dark) colour phase. The pale phase is by far the more common of the two. I have seen the odd melanistic bird in migration in Manitoba and of the ones found breeding in the Stonewall area only one was in this dark phase. An adult female from a nest in the Municipality of Rosser area (observed by V.H. Scott) was also melanistic.

One of the earliest hawks to depart for the south in the fall, the majority of Swainson's Hawks have left Manitoba by the end of September. Some extreme late dates for the province are October 17 at Raeburn and October 18 at Margaret.

"the most crooked that fancy can conceive"

John McDonnell

GEORGE E. LAMMERS
Manitoba Museum of Man & Nature

To one who thoughtfully ponders the centuries and
Surveys the whole in the clear light of the spirit, ...
Oceans and continents alone are of account.

Goethe.

Yes, it is good to ponder this continent of ours and the processes that form and change it. Everyone knows that volcanoes, earthquakes and faulting change the aspect of the land, but what of the ceaseless gnawing of the river as it winds its way to the sea? Through its continual transportion of particulate material from the land surface and especially during its rampaging flood stages, the river can sculpt the earth as efficiently as any other earth process.

Anyone who has flown over southern Manitoba has his attention called immediately to the crooked pattern of its many meandering streams. Around Winnipeg itself three major rivers, the Seine, Red and Assiniboine, lazily course their paths across the flat prairie, looping back upon themselves. If observed over very great periods, they change their course, form new loops, break through old ones and thus show a changing river bed. Let us examine briefly how some of these features are formed and their significance to man in Manitoba.

Meandering rivers, so typical of southern Manitoba, are characteristic of what has in the past been called "mature" or "old" rivers. Such rivers have gentle gradients and low velocity, generally carrying the smaller fractions of particulate matter such as clay and fine sand. The river bed rests in material that has formerly been deposited by the river and by this meandering characteristic creates a river valley that is quite wide and relatively level. However, many of the meandering rivers in Manitoba, while

having this same "mature" and meandering appearance, have a slightly different genesis. They too are traversing over wide expanses of fine sediments, but because of their comparative youth and analysis of the sediments in section, it soon becomes apparent that the sediments were not deposited by the river. Rather, the rivers are traversing the near horizontal sediments of former Ice Age lakes such as Lake Agassiz. Because of the extreme flatness, it is difficult for the rivers to carry their sediment load and thus it drops from suspension. The river then seeks to cut a new channel to bypass the bed deposits causing the river to initiate a meandering pattern. Such a stream has a reduced gradient and thus reduces the velocity of its water, so that it has only enough energy to transport its load of mud, sand, and gravel, not enough to scour its channel any deeper. At this stage the river uses its energy to cut laterally.

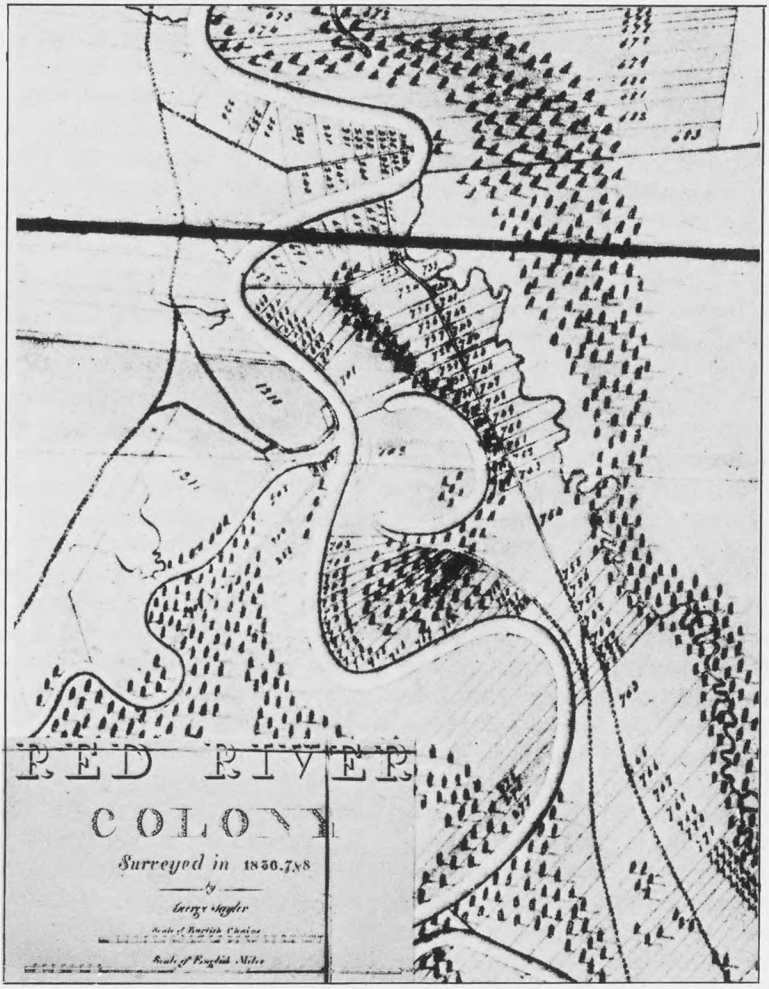
The meanders of such a stream never stay in place for very long, but move from side to side, migrating downstream in a sinusoidal wave pattern much as a jumping rope that has been shaken. This motion of the meanders may not be obvious in the span of a few years, but during the course of a few hundred years there are apt to be important changes in the path taken by such a stream. In the early days long stretches of the Mississippi and Missouri rivers were used as state boundaries. Modern topographic maps now show that in many places the rivers literally have moved miles from their former positions as marked by early boundaries.

Generally such a stream is confined to a channel on a flat surface, but at times of flood, the entire valley floor or flood plain may be inundated. Frequently a river leaving its meandering channel during a flood will follow the steeper gradient across a meander and may eventually breach the neck of land within a meander loop. At the same time, it establishes a shorter course and increases its velocity and thus its carrying capacity. For a period of time the river is able to carry a larger load over this disturbed area causing it to deepen its channel or transport more material. Generally, because of the decreased flow within the former meander loop, sediment will fall from suspension closing circulation through the meander, thus forming an oxbow lake such as Crescent Lake at Portage la Prairie.

Meanders generally shift outward and down stream. Such a stream is flowing more swiftly along the outside curve of the meander loops and it is here that the stream impinges on the bank and cuts it away. On the inside curve the stream is flowing slower and deposits part of its load.

The meandering of rivers led to much consternation to those who wished to use them for navigation. La Verendrye, in September of 1738, decided to go by land to trade with the Assiniboine and Mandan Indians, because of the shoals of the Assiniboine and the windings of the river. He left the freight canoes to thread the many oxbows of the Assiniboine, with the provisions for his long journey (Morton, 1957. p. 31).

John McDonnell, a fur trader in the 1790's reported that "... a man on foot, who marches straight through the plain, in three hours can go as far as canoes go in a day," his explanation being that the river was "very shoal full of sand banks and one of the most crooked that fancy can conceive." Because of this and the limited amount a pack horse could carry, the Red River Cart was soon to become the

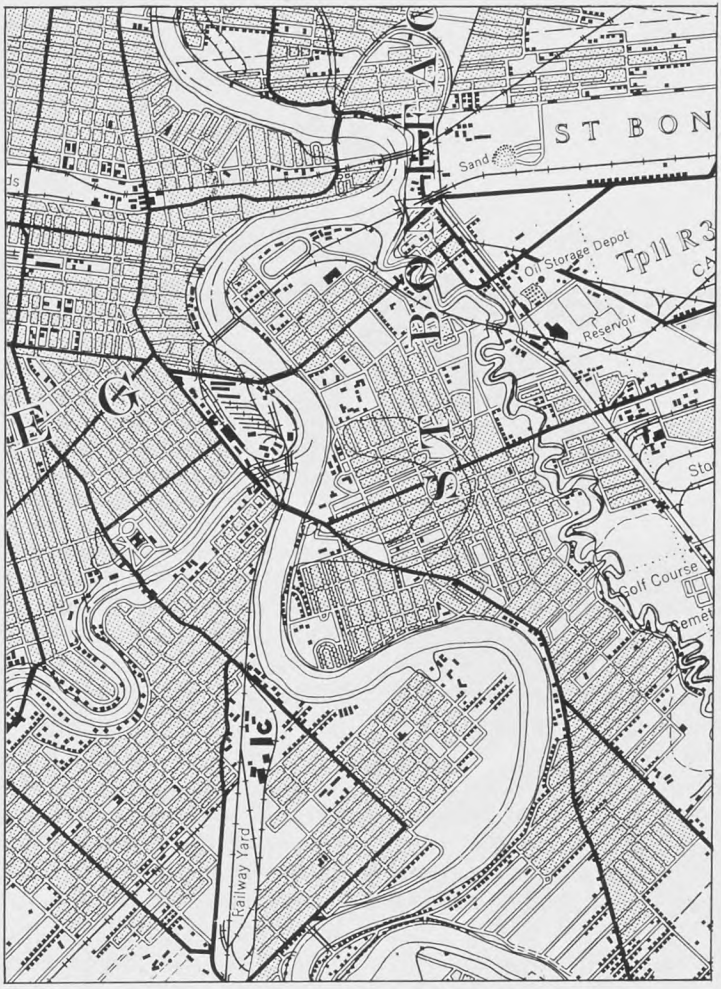


Hudson's Bay Archives

Oxbow on the Red River

freight hauler of the province.

In a later period oxbow lakes (cut off meanders) noticeably affected early settlement patterns. This is especially noticeable in urban areas, a very good example occurring in St. Boniface. Early survey maps of Winnipeg, Manitoba, such as one by Duncan Sinclair and George McPhillips in "Plans of River Lots, in the Parishes of St. John, St. James and Saint Boniface, Province of Manitoba," 1873 (Warkentin and Ruggles, 1970, p. 254), illustrates this very well. There is an oxbow lake (called slough on above map) on the eastern bank of the Red River opposite its junction with the Assiniboine River, that is still detectable as an elevational difference and is so marked on modern day topographical maps. Along the eastern margin of this former meander of the Red River is Enfield Crescent,



and now

in a position dictated by the topography. Presently the slough is laid out in streets, and supports many buildings, having been drained and partially filled.

Meandering rivers will continue to be with us for some time in the future, and as long as man is on the earth will continue to be thought provoking. At the same time their serpentine nature will add an aesthetic dimension to our lives on a magnitude seen nowhere else in nature. To many people, it will form a certain amount of "waste" land, but it is in such areas that many of the essential processes of nature continue, such as nesting sites for our waterfowl; and for man, a quiet place to be alone with his thoughts.

In the teeming Everglades

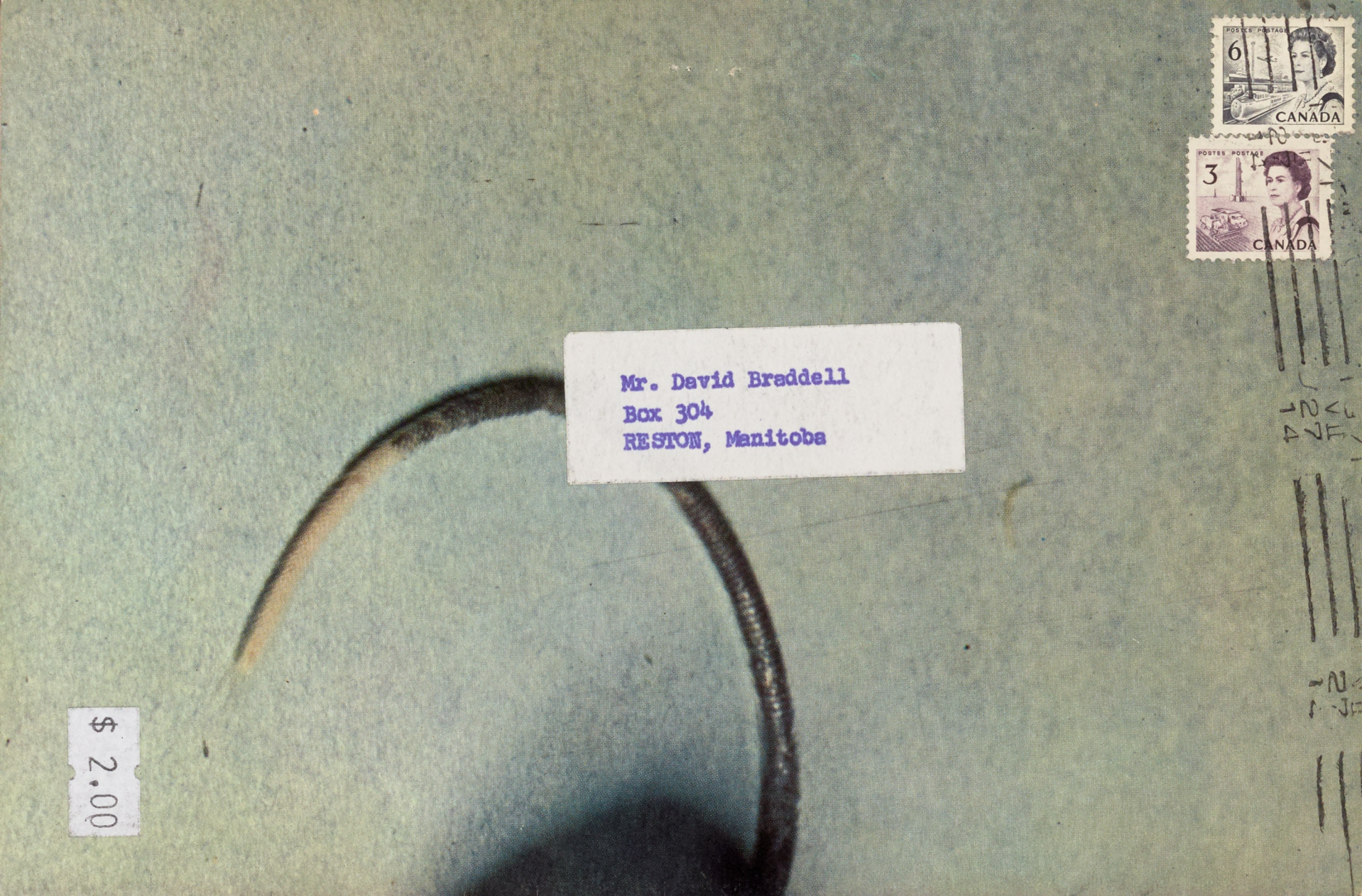
D. SCHWANKE

By the beginning of March, Manitobans are prone to get a feeling of being fed up with winter and many of them seek confirmation in warmer climes that sunshine can actually be quite warm. Therefore I journeyed south in March to go exploring in the Everglades of Florida.

As everyone knows, the variety of animal species in southern regions is luxuriant. The most remarkable impression I received in the Everglades was of this variety and the fast turnover of life.

In the dry season there water gathers in small pools and wildlife wanders there in concentration. Alligator Gar and sunfish in great numbers provide food for Alligators, Anhingas and many other forms of wildlife. Louisiana Herons, Little Green Herons, Little Blue Herons, Great Blue Herons, Great White Herons, various egrets, Purple Gallinules, Florida Gallinules, and many other birds wade along the shallows to feed on insects, catch a fish, a baby alligator, and sometimes are eaten by larger alligators. Raccoons which sneak along the shores in quest of eggs and sundry nourishment are apt to walk into the waiting jaws of alligators. An Indigo Snake just finishing a meal of eggs is snatched skyward by a Red Shouldered Hawk. A large Soft Shelled Turtle comes too close to a twelve foot alligator which snatches his victim, swims to shore, and there smashes it to death against a rock. Five smaller alligators rush in to get hold of some bits and pieces in the vicinity but have to watch each other lest one walks into the other's jaws of death.

In our northern regions the species are somewhat limited, but exist in greater numbers. In the vastness of our northern country the animals seem also more dispersed. Not very often are we confronted with evidence of turnover of life, although it does, of course, exist. All higher forms of life must die, some through aging and others through predation.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